Sustainable livelihood and seaweed farming in Calatagan, Batangas, Philippines

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Abstract

The study aimed to assess the contribution of seaweed farming based on sustainable livelihood framework using an indicator system formulated at the FAO Experts Workshop on Methods and Indicators held at Nha Trang University in Vietnam last November 2008.

***Key words**: small scale aquaculture, seaweed, Philippines*

INTRODUCTION

Philippines is known as an agricultural country. This is true until now. More than half of the total households of the Philippines still depend on this type of system. One of the significant compositions of agriculture is the aquaculture. The country is an archipelago of 30 million hectares of land and a coast line of around 17,460 km. Opportunities for a living is supplied with vast territorial water. It reaches up to 220 million ha. Fishery is an advantage. This had been the traditional and major sector of the national patrimony and economy. It contributed 28.16 % of the total agricultural output in the 1st quarter of 2010 (BAS 2010). The Bureau of Agricultural Statistics (BAS 2008) shows that aquaculture has significant contribution in terms of production and value.

This is being supported by the Food and Agriculture Organization (FAO). The aquaculture plays a significant role in the country. It contributed a lot to food security, employment and foreign earnings. FAO (2010) explained that aquaculture in the Philippines mostly consisted of seaweed farming, milkfish, tilapia, shrimp, carp, oyster, and mussel production. But each of this system faces the challenges that include: developing new markets, strengthening the market competitiveness, reducing the farming risks, planning on how to cope with the international trade and completion and implementing.

This study will focus on seaweeds, particularly, on *Eucheuma* species. Seaweed farming in the Philippines accounted for 69% of the total aquaculture production (BAS 2008). Interventions extended by the Department of Agriculture- Bureau of Fish and Aquatic Resources (DA-BFAR) and LGUs in terms of seedling dispersal and other technical assistance, coupled with its observed profitability, are generally perceived to be the primary reasons for the increase in production such as in the case of Palawan. This province was the top producing province where seaweed farmers harvested about 444,355.44 metric tons in 2008. High price of seaweed and sure market significantly motivated farmers to grow it.

The story of popularity of seaweed as a good income source dispersed. Many had been encouraged to do it as it involves small capital. Also it is not so laborious. Many communities had been helped by seaweed farming. However, in terms of the assessment of the contribution of the seaweed farming, there are difficulties. One of the major problems is lack of data. Production statistics is one of the things at hand. But the full data that involves full qualitative and quantitative data is not available. Another thing is that there is a big possibility that the small scale ones are neglected or worse unaccounted. Furthermore, there are either insufficient or lacking indicators that can really assess the full contribution of the seaweed farming. From the given problems, the quest on facing the challenges

mentioned above is difficult. Also since there is no concrete data to prove and document the stories of this system, policies are short.

In order to answer the needs, FAO took the initiatives. Last November 2008, an Experts Workshop on the "Method and Indicators for Small Scale Aquaculture (SSA) had been held at Nha Trang University in VietNam. Experts are from the field of aquaculture, aquatic animal health, ecology, economics, sociology, human geography, law and information. The objectives were to formulate a set of guiding principles for the SSA development and to select an appropriate framework.

The team analyzed and consolidated the strength of the Sustainable Livelihood Approach (Figure 1). The sustainable livelihood systems considered 5 basic but important aspects such as the natural (N), physical (P), human (H), financial (F) and social (S) capitals. The SLA recognizes the changes in the system as well as in the aquaculture itself. In the framework, the vulnerability as influenced by the transformations on structures and processes is being considered. The concept of vulnerability can consider the sensitivity and the resilience of the system (Turner et. al. 2003; Villanueva 2008). This aspect affects the sustainability of the livelihood strategy and targets (Espaldon 2008).

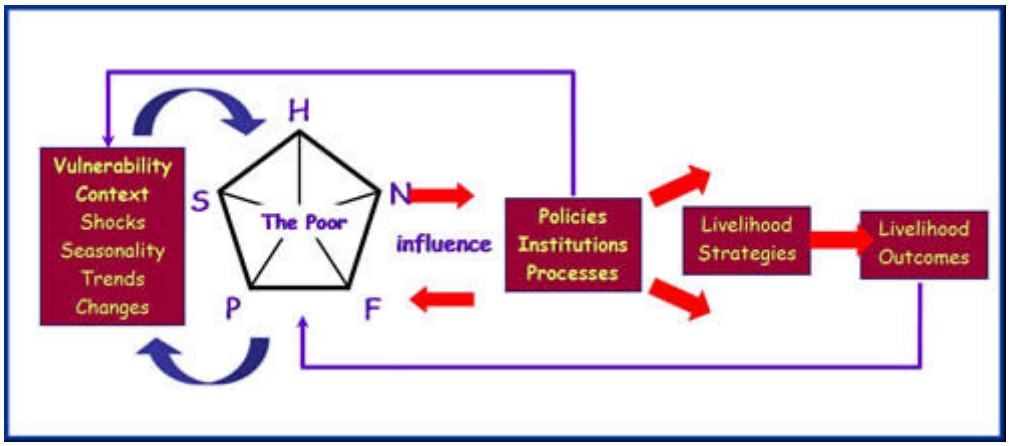

Figure 1. The rural livelihoods framework as a means to understand natural resource management systems (Source: UK Department for International Development).

Vulnerability includes shocks, trends and seasonality that are beyond the control of the households. Shocks may be in the form of extreme climatic events such as storm and droughts, pollution and outbreak of green tide. Livelihood strategies can be constructed around the access to capitals and the political and economic context. These can be in the form of fish cage activity which allows poor fishers to invest in aquaculture. Related strategies include fish drying, in the event that there is boom harvest, or fish processing.

Objectives:

The main goal of the case study is to assess the contribution of seaweed farming to the rural development using the (Nha Trang) indicator system proposed here. The specific objectives are:

1. To develop a survey instrument that can be a template for assessing the contribution of small scale aquaculture to sustainable rural development;

2. To pre-test/calibrate the instrument and its applicability to selected small scale aquaculture and
3. To use an indicator system to measure the contribution of small scale aquaculture to sustainable rural development.

METHODOLOGY

Small scale aquaculture is defined in this study as an aquatic farming system whose ownership is typically family and/or community-owned, with relatively small size of landholding and often limited access to resources. Small-scale aquaculture can be Type I which refers to the systems involving limited investment in assets, some small investment in operational costs, including largely family labor while Type 2 refers to systems in which aquaculture is the principal source of livelihood, in which the family/operator has invested substantial livelihood assets. Seaweed farming appears to belong to Type 2. It requires some level of investments and technology.

The study focused on small scale seaweed operation. On this consideration, Calatagan in Batangas had been chosen. The list and the area of Calatagan had been surveyed. Based from the initial ocular visit and advice from the municipality's Department of Agriculture, Poblacion II was selected. Pre-test and calibration of the structured survey instrument had been done as well. It was found out that some of the indicators and questions were not applicable to the type of aquaculture activity present in the area. The survey instrument was then further refined. Answers from the questionnaires were based from the 2008 experience and accounting.

There were 122 permit holders listed for the year of 2008. However, on the household basis, there were only 95 of them. Among these household, twenty-five selected *Eucheuma sp.* growers were randomly selected for an interview. Key informant interview had been conducted as well. The survey instrument used the indicator system developed in Nha Trang. Each indicator was carefully assessed. Table 1 provides the details of the indicators and how contributions can be assessed.

Table 1. The Indicator system (developed in Nha Trang, 2008)

Contribution	Indicators
Natural capital (N)	
1. Efficient use of materials and energy saving	1. Types and Number of nutrient flows
2. Efficient use of water	2. Number of farm production uses of water
Physical capital (P)	
3. Build up of SSA farms and farm assets in rural area	3. Number of SSA farms and farm areas increased over 3 years in the study area
4. Build up of rural physical assets	4. Types and number of rural infrastructure investment induced by SSA
5. More efficient use of built physical assets in rural area	5. Types and number of rural infrastructure investment induced not purposely for SSA but benefit SSA
Human capital (H)	
6. Food and nutrition security	6. Per capita annual consumption of fish in SSA household. (Only fish for their own SSA harvest.)
7. Seasonal food security	7. Is there season in a year when household much relies on their own harvest than on fish from other sources?

Financial capital (F)	
8. Household cash income	8. % of cash income from SSA to total household cash income
9. SSA serves as a source of household economic security	9. Economic return from SSA to household
10. Contribution to provincial economy	10. % of economic value from SSA production to the value of production from all aquaculture in the province
Social capital (S)	
11. Social participation	11. % of farm households are active members of SSA programs/ associations/ organizations
12. Women empowerment	12.1 % of number of SSA farm activities in which women take the major decision-making role 12.2 Role in community and community organizations
13. Fostering social harmony	13.1 Number of SSA households that share fish products and other farm resources 13.2 Number of activities in which farmers work together as to improve the shared resources in the community (such as water system, road and reservoir)
14. Providing social safety net	14. Ratio of family labors who previously worked solely or mainly in non-SSA (incl. off-farm jobs) but now work in SSA (X) to total family labors (Y)

Aside from the structured survey questionnaire, the team used a combination of research techniques which include review and analysis of secondary data, key informant interviews, field observations, and photo documentation. Results were encoded; frequencies and tabulations were made. Data were gathered according to the indicators' need. Cost and return analysis was employed to compute for the income and savings. This also helped in the assessment of the economic contribution of the seaweed farming operation. Validation is an essential activity that was also conducted after the assessments had been done.

RESULTS AND DISCUSSION

Description of the study site

Calatagan in the Province of Batangas is situated 110 km south of Manila. It lies at 13° 50´ latitude and 120° 38´ longitude (Figure 2). The land cover is approximately 10, 528 ha. It experiences dry and wet seasons. It is covered with plains and the shorelines are traced with swamps and marshlands. This area is covered with fishponds and coral reefs. The slope ranges from 0% to 3% to 50% and above. Land use built-up areas, tourist spots, agricultural land, roads, a planned unit development, swamps, fishponds and bodies of water and grasslands (CLUP 2008).

It has twenty-five (25) barangays. Four (4) barangays are classified as urban and twenty-one barangays (21) are rural. In year 2000, the population was 45,068 and it was expected to reach 57,146 by the year

2010. The average growth rate in between year 1995 to 2000 is 2.14 %. From the year 2000, only 16 % composed the urban population. The projected household population by 2010 is 11,426.

Seaweeds in Calatagan

Seaweed farming in Calatagan was introduced by Dr. Gavino C. Trono, a University of the Philippines marine scientist in the 1970s. Dr. Gavino Trono is one of the renowned pillars of seaweed farming in the Philippines. The first seaweed farmer, Mr. Edgar Limoico, a resident of Calatagan, was his Research Assistant during the research stage of seaweed farming in the area. He gradually turned seaweed production into a profit earning business enjoyed not only by his family but the other residents as well. To date, permit holders accounted to 122 covering an area of 2000 sq.m (for each permit holder).

Two types of seaweeds are grown in Calatagan. These include "Lato" or *Caulerpa* and "gulaman" or *Eucheuma*. The residents sell seedlings to other farmers in the area and to the Bureau of Fisheries and Aquatic Resources (BFAR). "Lato" is supplied to the Manila market and other neighboring barangays. It is also exported to Japan for company needs. *Eucheuma* (commonly referred to as "gulaman"), on the other hand, is sold dried for a trading to Cebu City. A collector in Barangay Poblacion 2 buys the seaweed from farmers; where the product is stored until it reaches enough volume for shipment to Cebu. The capital is provided by a Cebu-based company which covers the seaweed, trucking and shipment costs.

Setting up is an easy process for the farmers. It does not require a lot of investment since materials only include bamboos, sticks, strings and the seedlings. Maintenance requires minimal time only. This includes replacement of each stick and strings every two to three times of use and the bamboos every year. There is really no need for other daily inputs. Planting and harvesting are the most time consuming activities for seaweed farming. Drying takes time as well.

After harvesting, packing is done in preparation for transport. From Calatagan, it is transferred to the Manila Pier. Then it will be shipped to Cebu to be picked-up by MCPI, Corporation. MCPI Corporation is a seaweed producer, manufacturer and exporter. Its goal is to produce quality refined natural grade carageenan. It supplies functional requirements for food and non-food industries. The food product line includes Foodgel that serves different functions for meat and poultry, dairy, dessert/confectionery, bakery, noodles and pasta, sauce and dressing, juice and seafood. While for the non-food Eugel hand out in the production of beer, canned food, air freshener, culture media, palletized feed, textile and toothpaste. (http://www.mcpicarrageenan.com/theproducts.html March 2009).

After the year 2008 is a sudden decline in the price of the seaweeds because of increase in production and supply. Before, it can be sold from PhP 60.00 (roughly 1.34 USD) to 90.00 (about 2USD) but now it only costs PhP 30.00 (around 0.70 USD). At present, the government office controls the number of units. Maximum area is limited to 2,000 square meters. This is to ensure the quality of coastal waters and to provide opportunity to others in Calatagan who would like to venture into seaweed farming. "Bantay-dagat" is a group of fishermen that guards the coastal and municipal waters from encroachment. It is said to be effectively doing its role because illegal entry or other illegal water resource use have been drastically reduced. Fisheries and Aquatic Resources Management Council (FARMC) is another organization that helps keep residents and farmers aware of the rules and regulations governing the use of natural resources in Calatagan.

Socio-economic structure (respondents)

The summary of the socio-economic characteristics of the respondents is discussed here**.** The ages of seaweeds farmers range from 27 to 68 with an average of 44 years. Although seaweed farming is a family activity, 60% of the respondents are male. Almost half (48%) of the respondents reached the elementary level, while 24% finished high school. Other respondents just reached high school (16%) and college levels (4%) while 8% finished their college degrees. The average household size consists of 5 members. The household ranges from 1 to 11 members.

The main occupation is seaweed farming as reported by 19 respondents (76%). A few reported fishing (8%) as their main source of livelihood while 16% are plying tricycle routes or working for the government and private sectors. More than 1/3 (36%) reported fishing as the secondary source of income while 16% had seaweeds farming as another source of income. Others accounted 20%. Notably, more than ¼ (28%) appeared to rely sole on seaweeds growing since they don't have secondary occupation.

Almost all the respondents owned only one (1) unit of seaweed area covering 2000 sq m, the average number of seaweed units was 2 due to the huge number (25 units) owned by 12 families that was consolidated as a family farm. In effect, each farmer is farming only one unit of seaweed farm. The average household income was PhP 690,528 (roughly 15,346 USD) per year; 47% or PhP 327,753 (almost 7,283 USD) came from seaweed farming. Average household expenditure for basic necessities was PhP 175,531 (around 3,900 USD) per year which was 53% of the income from seaweeds and 25% of the total household income.

Contribution of seaweed to sustainable rural development using the Nha Trang Indicator System

The indicators used to assess the contribution of seaweed farming to rural economy of Calatagan are discussed in this part. In total, the team considered 14 indicators to measure five categories of contribution. These are natural, physical, human, financial and social capital anchored on the sustainable livelihood framework (Figure 1).

Natural capital

Indicators 1 and 2 – efficient use of materials and energy savings and types and numbers of nutrient flows

Based on the table of contributions and indicators, the efficient use of materials and energy savings and use of water can be measured in terms of determining the types and numbers of nutrient flows and the number of farm production uses of the water (Indicators 1 and 2). In the case of Calatagan seaweed farmers, the recycling and reuse of water is not significantly reflected in the way they practice Eucheuma farming. For example, all of the respondents use groundwater or deepwell for domestic water use; and buy their drinking water. The households recycled their kitchen leftover for domestic animals and livestock and poultry. Plastics and other non-biodegradable wastes are collected by the municipal government, in line with their vision to place ecotourism at the heart of their economic and development programs.

What is prominent among the households is the knowledge and perception that seaweed farming depends significantly on the quality of marine water. This is the reason why they make active representation to the local government through the FARMC. Leaders of FARMC sit on the Local Development Council of the Local Government of Calatagan. The officials of the barangay (village) FARMC in the study area as well as the officials of the LGU highlighted the perceived adverse impacts of mariculture on small scale seaweed farming. Other perceived threat to water quality which is detrimental to seaweed farming is the operation of a big hotel and restaurant in the vicinity. It is

commonly observed that when shrimp ponds and swimming pools release waste water to the coastal area, Eucheuma seedlings just melt away.

For lato, seaweed, the main threat is the siltation of the seabed's, which prevents the lato seedlings to grow as they used to. Lato normally grows in the area, but this is not the case at present. Respondents and key informants perceived that this due to increasing siltation from the lands surrounding the coastlines.

Physical capital

Indicators 3, 4 and 5 – SSA farm and farm assets build up, rural physical assets and types

Because of observed profitability of seaweed farming especially in 1990s when the price reached about PhP100 (2 USD) per kilo, gradually the number of farmers engage in seaweed farming grew (Indicator 3). When it started in the late 1980s until early 1990s, there was only one family in the village who was into large scale seaweed farming. Today the number of SSA farmers in the village increased to about 122. This seeming profitability of seaweed farming did not translate into increased property or other investments in rice field, orchard or vegetable farm**.** Data collected from sample population showed that seaweed farmers, who are also fishermen, would rather invest on livestock and poultry instead.

On whether seaweed farming induces the building up of rural infrastructure (Indicator 4), study showed that the enterprise require regular infrastructure that the local government provided earlier and even before the seaweed becomes a popular livelihood. The access road around the barangays is constructed to serve the general needs of the community**.** Groundwater and deepwell pumps are built by the individual households and share it with the neighborhood. The main infrastructure that was developed to support seaweed farming is the store that sells, among others, seedlings of Eucheuma.

In terms of more efficient use of built physical assets in the rural area (Indicator 5), the construction of the barangay road and the provision of electricity benefit the seaweed enterprise. The barangay road provides convenient transport of the products (dried Eucheuma and fresh lato) to the market. A trader or collector buys the produce from small producers in the barangay, and then these are brought to Manila by truck. The product can either go to Cebu or to Japan.

Human capital

Indicators 6 and 7 – food, nutrition and seasonal food security

The seaweed farmers started stocking seaweeds on the month of February. Majority (9) of them stocked seaweeds on the month of May due to rainy season**.** The rain gives cooling effect to the water of Calatagan Sea which was favorable to the growth of seaweed. From February to May, they do not have income from seaweeds. During these months, they continuously stocked seaweeds to increase their harvest.

The farmers started harvesting on the month of June, but most of them (14) harvest on the month of September**.** They did not rely on seaweed as source of food but rather as source of income (Indicator 6). The income they derived from seaweed was used to buy their food, medicine and other necessities. The seaweeds cannot be a use as a measure for seasonal food security in terms of food per se.

However, as explained the income for the seaweed production can be use to support the necessities of the family (Indicator 7).

Financial capital

Average Annual Household Expenditures

The average household expenditures of seaweed farmers were PhP 175, 531 (almost 3,250.57 USD) per year. Of these amount, expenses for rice, electricity, water and telephone bill that amounted PhP21,646.72 (roughly 482 USD) to PhP20,348.40 (around 452 USD), respectively contributed 12% each to the total household expenses. This relatively high expense for water, electricity and telephone bill may be attributed to the purchase of purified water for drinking purposes and the purchase of prepaid card for mobile phones. The expenses for meat and poultry that contributed 10% to total expenditures came in next, followed by school allowances and social expenses that contributed 8% each to total household expenses.

Indicator 8. Household Cash Income

Seaweed farming is expected to contribute to financial capital in terms of the % harvest value from seaweeds growing to household food expenditure for protein food. Since *Euchuema* is not used for food directly, it does not provide as substitute for fish or any food item. However, since most of the seaweed farmers are also fishers, the fish they caught are often times used as foods. The income from seaweeds which constitute 47% of total income was used to finance household consumption which was equivalent to only 53% of the income from seaweeds. This indicator is not applicable for seaweed farmers since seaweeds are not used as substitute for fish.

The study examined carefully the contribution of seaweed farming as an SSA as a source of household security using economic return from SSA to household as an indicator **(Indicator 9)**. As discussed earlier, average net income from seaweeds farming was PhP 327,753 (USD 6, 973.46) which contributed 47 % to total household income. Based on this, it appears that seaweeds farming, under normal situation, could give sustained income to the household. In addition the net income from seaweeds was more than enough to cover the annual household expenditures.

Inputs and Cost in Seaweeds Farming

Cost of land or water is free for seaweeds farming since seaweeds are grown in coastal water. However, the farmers permit fee to operate amounting to PhP 170 (around 3.8USD) per unit equivalent to 2000 sq m to the municipal government. The major inputs in seaweeds farming are seedlings, bamboo poles, sticks, plastic straw and labor. On the average, a farmer used 3,590 pcs of seedling, 6 pcs of bamboo poles and 93 pcs of sticks per unit per year. Together with these, 16 rolls of plastic straw were used to tie the sticks and bamboos together and to tie the seedlings. Sixty six mandays of labor, 73% of which was family labor, for gathering seedlings, planting, harvesting and drying were used per year.

The production cost of growing seaweeds amounted to PhP36,526.10 (almost812 USD) per year. Of these amount 68% was attributed to cash costs and 32% to non-cash cost. Of the total cash cost, seedlings and raft (bamboo and sticks) contributed PhP17,387.60 (around 387 USD) and PhP3,749.00 (almost 83USD) that represent 43% and 9%, respectively, of the total cost. Hired labor contributed 9% of the total costs while permit to operate, which costs Php170 (roughly 3.8 USD)per unit,

contributed very minimal amount. Value of family labor that was equivalent to 32% of the total cost represented the non-cash costs.

Indicator 9. Economic return from SSA to household

Cost and Return of *Eucheuma* Farming

This would represent the economic return of producing *Eucheuma* to the farmers. The income and costs were computer on a per unit (200 sq m) during the 2008 production period. The average yield in dried equivalent was 2,519 kilograms. The average price received per kilogram of dried seaweeds received by farmers last 2008 was PhP80 (almost 1.8 USD) which gave a gross income of PhP202, 067.20 (around 4,490 USD) per unit. On the other hand, the total cost of producing the seaweeds amounted to PhP36,526 (roughly 812 USD). This leaves a gross net income of PhP177, 090.23 (around 3,935 USD) per year. If the non-cash cost was considered, of which it should be earned by the farmer, net income would be PhP165,541.43 (3,679 USD). Also, since seaweed farmer can harvest at least two times a year, total net income for a year would be PhP 331,108 (roughly 7,357 USD). Compared to the total household expenditures, the gross net income from a unit if Eucheuma would be sufficient to sustain household expenditures.

The results of the cost and returns analysis showed that, considering the current situation of *Eucheuma* growing in Calatagan, Batangas, income from a unit (2000 sq m area) of seaweed farming household would be able to sustain the household needs of the family. The contribution of *Eucheuma* growing to the total household income is sufficient to meet the household expenses. It should be noted however, that 2008 can be considered as the best year for seaweed farmers due to high price. During other years, the average price of dried seaweeds was only PhP50 (around 1.2USD) per kg. Hence, it calls for policy on how to keep seaweed prices reasonable.

Indicator 10 Contribution of Seaweeds Growing to Community Development

The production of seaweeds contributed 69% to total aquaculture production in the Philippines in 2008. Region IV-A is one of the Regions that produced seaweeds although with minimal contribution of almost 3% to total production. Calatagan is one of the municipalities where seaweeds are grown due to its proximity to coastal water that is suited for seaweeds production. The municipality contributed 21% to total production in Region IV-A, 24.60% of which came from Barangay Poblacion 2. *Eucheuma* is the mostly grown seaweeds in Calatagan. *Eucheuma* is the source of carrageenan, one of the world's foremost food and industrial additives today. It is a valuable substance used in gelling, suspending, thickening or water-holding properties in various products.

The value of seaweeds recorded for the Philippines pertains to fresh seaweeds. As such, due to bulkiness, the value of seaweeds was relatively low contributing only 10% to total aquaculture value. This is so because there is no value added done to seaweeds at the farm level. The only processing done was drying. Value addition was done at the industry level. Considering the multi-use of processed *Eucheuma*, the species grown in Calatagan cannot be denied that the municipality contributes to community and national development.

Social capital

Indicator 11 – Membership to SSA association and organization

It is surprising to note that in the study village, there is very low social participation in terms of membership to SSA association and organizations (Indicator 11). Of the total respondents, 64% are not a member of any organization. Twelve % (12%) of the respondents are members of CARD Bank, Inc. (Center for Agriculture and Rural Development) which is a microfinancing institution (Table 13). Normally, they use this facility for the investment they need for seaweed but not always. They also use this for emergency needs. Another 12% of the respondents are members of BASEFA (Batangas Seaweed Farmers Association), although their participation is limited to meetings. Membership to Barangay FARMC, ELFARCO and PBMA is limited to only 1%.

However, key informant interviews revealed that most of the households in this barangay are somehow related to one another by blood or by marriage. Hence, the dissemination of information and other related matters from the municipal level to the barangay through the Barangay FARMC official who is the first seaweed farmer and who was also able to diversify the family's economic activities into trading seaweed and a managing a general store in town.

Indicators 12.1 and 12.2 – Involvement in major decisions and community roles of women

Assessment on the women empowerment is also included (Indicator 12.1). In seaweed farming, major decisions on establishing the farm, management and operation and input procurement were done by the husband (68%). There were a number of women (36%) who decides on the selling and allocating the harvest and in the input procurement (24%). There were also instances where both husband and wife (24%) decide together i.e. management and operation of the seaweed farm and sell and allocation of seaweed. Very few of them (24%) records their expenses on the operation of seaweed and on household expenses. They based their responses on recall and asking the other members of the family. When the survey was conducted, the wives helped in answering the question. It is usually the wives who recall the amount of harvest and prices of seaweeds during the harvest months. For the opportunities given by SSA, it seems that there had been minimal opportunities that the respondents were involved. Only two (2) wives are involved in the shops and SSA supplies and operation. There are six (6) people involved in trading. Mrs. Limoico for example, established her own store last year. The investment came from the earnings from trading the seaweeds last year. The store includes SSA and fishing supplies like ropes, straws, etc. Also some things for the needs of the community are in it e.g clothing. . No opportunity for the community role was identified (Indicator 12.2).

Indicator 13.1 and 13.2 – Sharing of farm assets, share of community work

For planting, seedlings can be bought, ask from a neighbor or a kin or get from own harvest (Indicator 13.1). Sixty-four (64) % practiced sharing of seedlings in the community while thirty-six (36) % either buy or get their seedlings from their harvest. In harvesting the seaweeds, only two % ask for a help while ninety-two (92) % use family labor or hire people for their services. The seaweed production as stated previously is a technology shared to the community by Dr. Trono, then passed on to Mr. Limoico. Eighty-eight % stated the same line while two % said they learned on their own. The Bantay-dagat is so strong in Calatagan. The involvement includes the community for watch keeping. They can easily determine if trespassers are present in the area. Together, they maintain the cleanliness of the seawater as well. In fixing their seaweed farms, ninety-two % have their own practices and strategies in doing so. Road maintenance for the community is a government concern. It is only when a certain local official ask them to have a community clean-up that they do things together (Indicator 13.2).

Indicator 14 – Source of alternative income

Ever since Dr. Trono and Mr. Limoico introduced seaweed farming, this activity grew. From the time when they have proved that seaweed can be a major source of income of alternative/complement with fishing through the years (Indicator 13). This activity had been passed on from generations to generations. The increase in the number of seaweed growers is almost proportional to the birth of the children. The knowledge was inherited by the young generation.

There is also a case of in-migration because the popularity of seaweed as a good income source shared out. When aquarium fishing was prohibited in Mindoro, some of the people migrated to Calatagan because of seaweeds. Their friends or family gave then the idea on how seaweeds can be produced and marketed. In seaweed farming you have no superior but yourself. Also since this is not time-consuming, the residents can do other things e.g. tricycle or jeepney driving. Other producers mainly depend their source of living in seaweed farming.

Policy Implication

It is apparent that *Eucheuma* farming is contributing to the household income of the family and development of the community. Since the seaweeds farmers are using the coastal water for free, it is important that they be sensitized on the need to keep the water clean for sustained aquaculture farming. Farmers should be vigilant in keeping cleanliness of the water and be guarded against the activities that would compromise water quality. Policy on how to make the price of seaweeds reasonably staple must also be in place.

CONCLUSION

Based on the study, seaweed farming contributes significantly to the household incomes. The increase in livelihood assets of rural household was observed using the indicators given. These indicators are: natural capital; physical capital; human capital; financial capital; and social capital. Natural capital is not applicable in the production of seaweeds. Left-over food normally goes to domestic animals or livestock. The producers use ground water for their household and livestock use. For the production, water from the sea and lake are used. For the physical capital, after the introduction of seaweed production, there had been an increasing number of producers.

The rural assets such as road, market, energy system, water system, etc. are not solely made for SSA use but benefited SSA. On human capital, *Eucheuma sp* is a good source of income to respond to these securities. This is because all *Eucheuma sp* producers give their harvest to the trader. For the financial capital, Income from *Eucheuma* sp is enough to answer the total household expenses. In the social capital, the respondents in Calatagan have their own organizations though women need empowerment. Most women still need some activities apart from looking after their family.

Sharing the knowledge in the production of seaweeds is prevalent in the site. Seedlings can be asked from a close neighbor or friend. The strictness of Bantay-dagat together with the community really favors the seaweed farmers in the area. Seaweed farming operated for more than a decade now. The producers proved that it is a good source of livelihood. As long as the government will allow and as long as there is a demand for these SSA products, the business will continue.

In general, the indicator system is broad enough to capture and measure the contribution to the natural, physical, human, financial and social capitals of the small farming households. For SSA Type 2 however, we found out that it is needed to do extra data collection to generate a clear picture of the value chain or supply chain to measure the contribution of this kind of SSA to the municipal and provincial economy. This would complement the information that is derived from the questionnaire.

The study re-affirms the need for sustained support to SSA as a poverty alleviation strategy because SSA remains to be significant in securing livelihood and food supply of low income households. The intervention of BFAR and other development-oriented is found to be highly relevant to the sector. Providing investment and credit; technical knowledge and quality seedlings are relevant undertakings noted throughout the study. At the moment, expanding the reach of the market would be imperative if we are to sustain good farm gate prices and continue to make the enterprise viable.

Acknowledgement

This project was funded by FAO. Also the team is grateful to the following people who wholeheartedly assisted in this research:

- Dr. Melba Reantaso (FAO);
- Thailand and Vietnamese colleagues—Tip, Pete, Um, Dung and Kim;
- Vice-Mayor Ruben Bautista, Calatagan, Batangas;
- Ms. Emelyn Custodio, Mr. Roylan de los Reyes of the Municipal Agriculture Office of Calatagan, Batangas;
- Mr. Manuelito de los Reyes, Municipal Agricultural Officer, Calatagan, Batangas;
- Mr. Edgar Durman, Municipal Planning and Development Officer of Calatagan, Batangas;
- Mr. and Mrs. Edgar Limoico of Pob II, Calatagan;
- Mr. Rico Ancog, Graduate Student, SESAM UPLB;
- Mr. Efraim Roxas, Instructor, CHE UPLB; and
- Engr. Janice B. Sevilla, RA, SESAM, UPLB

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